

## PATENT ABSTRACTS OF JAPAN

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H01M 10/40

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(71)Applicant : FURUKAWA BATTERY CO LTD:THE

(22)Date of filing : 12.09.1991

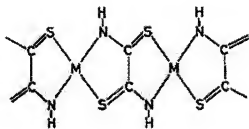
(72)Inventor : MATSUKI KENZO  
SUGAWARA RIKURO  
TANNO SATOSHI

## (54) NONAQUEOUS ELECTROLYTE BATTERY

## (57)Abstract:

PURPOSE: To stabilize discharge voltage to enable feeding of stable voltage by using as the positive electrode active material of a battery a coordination polymeric complex such as a rubeanic acid-copper complex and a 2,5-dihydroxy-P-benzoquinone-copper complex both of which can be delocalized within molecules.

CONSTITUTION: A high coordination polymeric complex for use with positive electrode active material contains ( $\pi$ ) electrons in molecules because organic molecules in which ( $\pi$ ) electrons or the like exist, and metallic ions are interconnected by coordinate bonds, and electric conduction is made possible by migration of the electrons and an oxidation reduction reaction is made possible and a fixed stable voltage is generated over a long time during discharge. A rubeanic acid complex or a 2,5-dihydroxy-P-benzoquinone-complex is employed as the polymeric complex. The structural formula of the complex is as shown in Figure, and to manufacture the complex an aqueous solution of copper sulfate is added to those elements to form a precipitate and the precipitate is decompressed and dried to form positive electrode active material. Similar effects can be obtained by using an aqueous solution of nickel chloride in place of the aqueous solution of copper sulfate.



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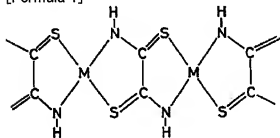
## CLAIMS

[Claim(s)]

[Claim 1]A nonaqueous electrolyte battery using a coordination polymer complex as positive active material.

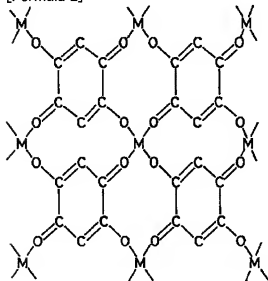
[Claim 2]The nonaqueous electrolyte battery according to claim 1 which is a rubeanic acid complex which has a structural formula showing this coordination polymer complex in the following-ization 1.

[Formula 1]



[Claim 3]The nonaqueous electrolyte battery according to claim 1 which is a 2,5-di-hydroxy-p-benzoquinone complex which has a structural formula showing this coordination polymer complex in the following-ization 2.

[Formula 2]



[Translation done.]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to a nonaqueous electrolyte battery.

[0002]

[Description of the Prior Art]Alkaline metals, such as lithium, are conventionally used as a negative electrode, using nonaqueous electrolyte, such as an organic solvent, as an electrolysis solution, The nonaqueous electrolyte battery with which conductive polymer substances, such as sulfides, such as oxides, such as  $\text{MnO}_2$ , and  $\text{TiS}_2$ , or poly aniline, were used as positive active material is proposed.

[0003]

[Problem(s) to be Solved by the Invention]As positive active material of the above-mentioned nonaqueous electrolyte, when  $\text{MnO}_2$ ,  $\text{TiS}_2$ , poly aniline, etc. were used, discharge voltage tends to fall gradually and voltage stable for a long time was not obtained.

[0004]

[Means for Solving the Problem]This invention solves the above-mentioned conventional fault, and provides a nonaqueous electrolyte battery with which voltage stable for a long time is obtained at the time of discharge, and a coordination polymer complex is used for it as positive active material.

[0005]

[Function]Since the organic molecule and metal ion in which a pi electron system exists have connected by turns the coordination polymer complex used as positive active material by coordination \*\*\*\*, Since electrical conduction is made possible by this electron transfer at intramolecular including a pi electron, and an oxidation-reduction reaction is closed if possible, the stable fixed voltage can be obtained over a long time at the time of discharge. As this coordination polymer complex, a rubeanic acid complex or a 2,5-di-Ed \*\*\*\*\*- p-benzoquinone complex is preferably used for obtaining the stable discharge voltage.

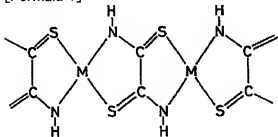
[0006]

[Example]Next, working example of this invention is explained in full detail. A little copper sulfate aqueous solutions were added every, and it went to the ethanol solution of the rubeanic acid (DTO- $\text{H}_2$  and brief sketch) held at 70 \*\*, agitating, and it was made to generate settlings. \*\* after neglecting it for several hours until a reaction is completed thoroughly It passed and settlings were isolated preparatively. These settlings were heat-treated at 120 \*\*, after performing reduced pressure drying at 80 \*\*, and the positive active material a was obtained. Instead of the above-mentioned copper sulfate aqueous solution, nickel chloride solution was used and the positive active material b was obtained by the same method as the above. About this positive active material a and b, differential thermal analysis and XRD analysis were conducted, and this positive active material a and b checked what is been a rubeanic acid complex which is a kind of a coordination polymer

complex which has a chemical constitution formula shown in the following-ization 1 (each the this inside M of a structural formula is [ \*\* and ] Cu or nickel, respectively) as a result of each analysis. That is, the former positive active material a checked that a DTO-Cu complex and the latter positive active material b were DTO-nickel complexes.

[0007]

[Formula 1]



[0008] Mix acetylene black 20 weight section with a mill as positive-active-material a50 weight section of the working example 1 above, and a conducting agent, and this mixture on a mortar, In the place which fully scoured after adding isopropyl alcohol as a wetting agent, and became slurry form. What added and kneaded polytetrafluoroethylene solution 30 weight section 60% as a binder, and made this mixture the shape of gum was fabricated to the sheet shaped with the merchant mill, this was stuck to the nickel mesh which is a metal charge collector by pressure, and it was considered as the electrode plate. The cell shown in drawing 1 was constituted using the nonaqueous electrolyte which melts in metal lithium as a negative electrode, and melts 1 mol of lithium perchlorate in the mixed solvent of the ratio 1:1 of propylene carbonate and dimethoxyethane as an electrolysis solution, using this electrode plate as an anode. This was set to lithium cell A.

[0009] in drawing 1 -- 1 -- a cell container and 2 -- nonaqueous electrolyte and 5 show a positive pole terminal, 6 shows a negative pole terminal, and, as for a negative electrode plate and 4, an anode board and 3 show the reference electrode of a lithium plate 7.

[0010] It replaced with the positive active material a used in working example 2 working example 1, and except having used the above-mentioned positive active material b, when the anode board was manufactured like working example 1 and it was shown in drawing 1 using this anode board, the cell of the same structure was constituted. This was set to lithium cell B.

[0011] For comparative example comparison, when three kinds,  $\text{MnO}_2$  which is the conventional positive active material,  $\text{TiS}_2$ , and poly aniline, were used as positive active material, respectively, the anode board was manufactured like working example 1, respectively and it was shown in drawing 1 using the each, the cell of the same structure was constituted. These were set to lithium cell C, D, and E, respectively.

[0012] The spark test (current density  $0.5 \text{ mA/cm}^2$ ) was done about these cells A, B, and C, D, and E. The result was as being shown in drawing 2. With Drawings, A, B, C, D, and E show each discharge voltage characteristic curve of the cell A, B, and C, D, and E, respectively. When the positive active material a and b of this invention is used from now on so that clearly, unlike the case where the conventional above-mentioned positive active material is used, the discharge voltage maintains surface smoothness and brings about the effect which enables supply of stable voltage.

[0013] Thus, in this invention, a coordination polymer complex is used as positive active material. Therefore, it was admitted that the nonaqueous electrolyte battery which gives supply of the stable voltage could be obtained.

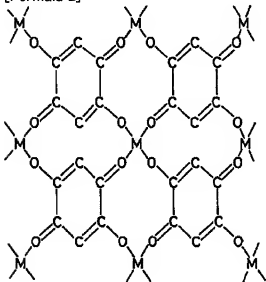
Next, working example of the coordination polymer complex of a different kind from the above is explained in full detail.

[0014] Agitating, a little copper sulfate aqueous solutions were added every, and it went to the

ethanol solution of the 2,5-di-hydroxy-p-benzoquinone (DHQ-H<sub>2</sub> and brief sketch) held at 70 \*\*, and it was made to generate settlings. \*\* after neglecting it for several hours until a reaction is completed thoroughly It passed and settlings were isolated preparatively. Reduced pressure drying was performed for these settlings at 80 \*\*, and the positive active material f was obtained. Instead of the above-mentioned copper sulfate aqueous solution, nickel chloride solution was used and the positive active material g was obtained by the same method as the above. About this positive active material f and g, conduct differential thermal analysis and XRD analysis, and as a result of each analysis this positive active material f and g. What is been a rubeanic acid complex which is a kind of a coordination polymer complex which has a chemical constitution formula shown in the following-ization 2 (this inside M of a structural formula is [ \*\* and ] nickel at Cu and this positive active material g with this positive active material f) was checked. That is, the former positive active material f checked that a DHQ-Cu complex and the latter positive active material g were DHQ-nickel complexes.

[0015]

[Formula 2]



[0016] Mix acetylene black 20 weight section with a mill as positive-active-material f50 weight section of the working example 3 above, and a conducting agent, and this mixture on a mortar, In the place which fully scoured after adding isopropyl alcohol as a wetting agent, and became slurry form. What added and kneaded polytetrafluoroethylene solution 30 weight section 60% as a binder, and made this mixture the shape of gum was fabricated to the sheet shaped with the merchant mill, this was stuck to the nickel mesh which is a metal charge collector by pressure, and it was considered as the electrode plate. Using this electrode plate as an anode, using the nonaqueous electrolyte which melts in metal lithium as a negative electrode, and melts 1 mol of lithium perchlorate in the mixed solvent of the ratio 1:1 of propylene carbonate and dimethoxyethane as an electrolysis solution, when shown in drawing 1, the cell of the same structure was constituted. This was set to lithium cell F.

[0017] It replaced with the positive active material f used in working example 4 working example 3, and except having used the above-mentioned positive active material g, when the anode board was manufactured like working example 3 and it was shown in drawing 1 using this, the cell of the same structure was constituted. This was set to lithium cell G.

[0018] The spark test (current density <sup>2</sup> of 0.5mA/cm) was done about these cells F and G. The result was as being shown in drawing 3. With Drawings, F and G show each discharge voltage characteristic curve of the cells F and G, respectively. The characteristic curve C, D, and E of the

cell C, D, and E which uses the aforementioned conventional positive active material was written together for comparison. Also when the positive active material f and g of this invention is used from now on so that clearly, it turns out that the discharge voltage is excellent in surface smoothness during battery discharge, and the stable voltage can be supplied.

[0019]

[Effect of the Invention] Thus, as positive active material of a nonaqueous electrolyte battery, when based on this invention, when using coordination polymer complexes, such as a DTO-Cu complex which can be delocalized, a DTO-nickel complex, a DHQ-Cu complex, and a DHQ-nickel complex, by intramolecular, the effect which enables supply of the stable voltage is brought about.

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**TECHNICAL FIELD**

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[Industrial Application]This invention relates to a nonaqueous electrolyte battery.

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PRIOR ART

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[Description of the Prior Art]Alkaline metals, such as lithium, are conventionally used as a negative electrode, using nonaqueous electrolyte, such as an organic solvent, as an electrolysis solution. The nonaqueous electrolyte battery with which conductive polymer substances, such as sulfides, such as oxides, such as  $\text{MnO}_2$ , and  $\text{TiS}_2$ , or poly aniline, were used as positive active material is proposed.

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EFFECT OF THE INVENTION

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[Effect of the Invention] Thus, as positive active material of a nonaqueous electrolyte battery, when based on this invention, when using coordination polymer complexes, such as a DTO-Cu complex which can be delocalized, a DTO-nickel complex, a DHQ-Cu complex, and a DHQ-nickel complex, by intramolecular, the effect which enables supply of the stable voltage is brought about.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]As positive active material of the above-mentioned nonaqueous electrolyte, when  $\text{MnO}_2$ ,  $\text{TiS}_2$ , poly aniline, etc. were used, discharge voltage tends to fall gradually and voltage stable for a long time was not obtained.

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MEANS

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[Means for Solving the Problem]This invention solves the above-mentioned conventional fault, and provides a nonaqueous electrolyte battery with which voltage stable for a long time is obtained at the time of discharge, and a coordination polymer complex is used for it as positive active material.

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OPERATION

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[Function] Since the organic molecule and metal ion in which a pi electron system exists have connected by turns the coordination polymer complex used as positive active material by coordination \*\*\*\*, Since electrical conduction is made possible by this electron transfer at intramolecular including a pi electron, and an oxidation-reduction reaction is closed if possible, the stable fixed voltage can be obtained over a long time at the time of discharge. As this coordination polymer complex, a rubeanic acid complex or a 2,5-di-Ed \*\*\*\*\*- p-benzoquinone complex is preferably used for obtaining the stable discharge voltage.

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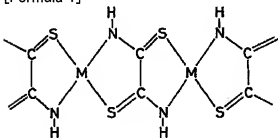
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## EXAMPLE

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[Formula 1]



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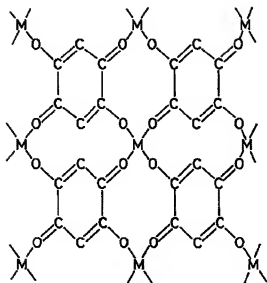
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Next, working example of the coordination polymer complex of a different kind from the above is explained in full detail.

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[0015]

[Formula 2]



[0016] Mix acetylene black 20 weight section with a mill as positive-active-material f50 weight section of the working example 3 above, and a conducting agent, and this mixture on a mortar, in the place which fully scoured after adding isopropyl alcohol as a wetting agent, and became slurry form. What added and kneaded polytetrafluoroethylene solution 30 weight section 60% as a binder, and made this mixture the shape of gum was fabricated to the sheet shaped with the merchant mill, this was stuck to the nickel mesh which is a metal charge collector by pressure, and it was considered as the electrode plate. Using this electrode plate as an anode, using the nonaqueous electrolyte which melts in metal lithium as a negative electrode, and melts 1 mol of lithium perchlorate in the mixed solvent of the ratio 1:1 of propylene carbonate and dimethoxyethane as an electrolysis solution, when shown in drawing 1, the cell of the same structure was constituted. This was set to lithium cell F.

[0017] It replaced with the positive active material f used in working example 4 working example 3, and except having used the above-mentioned positive active material g, when the anode board was manufactured like working example 3 and it was shown in drawing 1 using this, the cell of the same structure was constituted. This was set to lithium cell G.

[0018] The spark test (current density <sup>2</sup> of 0.5mA/cm) was done about these cells F and G. The result was as being shown in drawing 3. With Drawings, F and G show each discharge voltage characteristic curve of the cells F and G, respectively. The characteristic curve C, D, and E of the cell C, D, and E which uses the aforementioned conventional positive active material was written together for comparison. Also when the positive active material f and g of this invention is used from now on so that clearly, it turns out that the discharge voltage is excellent in surface smoothness during battery discharge, and the stable voltage can be supplied.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a sectional view of the nonaqueous electrolyte battery of one example of operation of this invention.

[Drawing 2]It is a comparison graph of the discharge voltage characteristic with a cell the cell of working example of this invention, and conventionally.

[Drawing 3]It is a comparison graph of the discharge voltage characteristic with a cell the cell of other working example of this invention, and conventionally.

[Description of Notations]

A, B, F, and G Discharge voltage characteristic curve of this invention cell

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[Translation done.]



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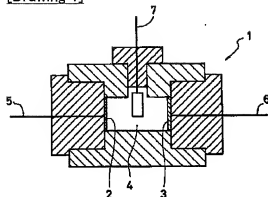
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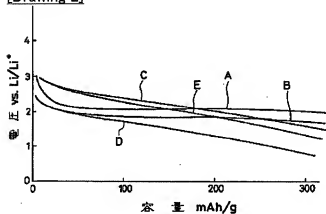
DRAWINGS

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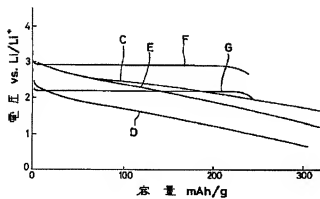
[Drawing 1]



[Drawing 2]



[Drawing 3]



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[Translation done.]

(19)日本国特許庁(J P)

(12) 公開特許公報(A)

(11)特許出願公開番号

特開平5-74458

(43)公開日 平成5年(1993)3月29日

(51)Int.Cl. <sup>3</sup>	識別記号	序内整理番号	F I	技術表示箇所
H 0 1 M 4/90		8520-4K		
4/92	C	8609-4K		
10/90	Z	8609-4K		

審査請求 未請求 請求項の数3(全4頁)

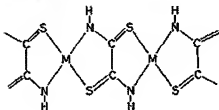
(21)出願番号	特願平3-308599	(71)出願人	000005382 古河電池株式会社 神奈川県横浜市長土ヶ谷区里川2丁目4番1号
(22)出願日	平成3年(1991)9月12日	(72)発明者	松本 健三 山形県米沢市城北2の3の7
		(72)発明者	菅原 隆郎 山形県米沢市通町5の8の24
		(72)発明者	丹野 雄 福島県いわき市常磐下船尾町杭出作23-6 古河電池株式会社いわき事業所内
		(74)代理人	弁理士 北村 和男

(54)【発明の名称】 非水電解液電池

(57)【要約】 (修正有)

【目的】 安定した放電電圧を供給し得る非水電解液電池を提供する。

【構成】 正副活性物質として配位高分子錯体を用いる。該配位高分子錯体の1例として、下記構造式を有するルベアン錯錯体がある。



(2)

特開平5-74458

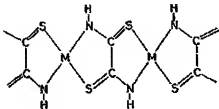
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【特許請求の範囲】

【請求項1】 正極活物質として配位高分子錯体を用いることを特徴とする非水電解液電池。

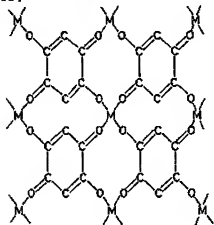
【請求項2】 該配位高分子錯体は、下記化1に示す構造式を有するルベアン酸錯体である請求項1記載の非水電解液電池。

【化1】



【請求項3】 該配位高分子錯体は、下記化2に示す構造式を有する2,5-ジエドキシシー-p-ベンゾキノン錯体である請求項1記載の非水電解液電池。

【化2】



【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、非水電解液電池に関する。

【0002】

【従来の技術】 従来、電解液として有機溶媒などの非水電解液を用い、負極としてリチウム等のアルカリ金属を用い、正極活物質として $\text{MnO}_2$ などの酸化物、 $\text{TiS}_2$ などの硫化物、或いはポリアニリンなどの導電性高分子物質が使用された非水電解液電池が提案されている。

【0003】

【発明が解決しようとする課題】 上記の非水電解液の正極活物質として、 $\text{MnO}_2$ 、 $\text{TiS}_2$ 、ポリアニリンなどを用いた場合は、放電電圧が漸次低下する傾向があり、長時間安定な電圧が得られなかった。

【0004】

2

【課題を解決するための手段】 本発明は、上記従来の欠点を解決し、放電時、長時間安定な電圧が得られる非水電解液電池を提供するもので、正極活物質として配位高分子錯体を用いることを特徴とする。

【0005】

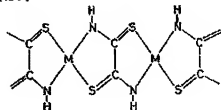
【作用】 正極活物質として用いる配位高分子錯体は、配位結合によって $\pi$ 電子系の存在する有機分子と金属イオンが交互に連結しているため、分子内に $\pi$ 電子を含み、この電子の移動により電気伝導を可能にし、酸化還元反応を可能ならしめるため、放電時、長時間に渡り一定の安定した電圧を得ることができる。この配位高分子錯体として、ルベアン酸錯体又は2,5-ジエドキシシー-p-ベンゾキノン錯体が、安定した放電電圧を得るに好ましく使用される。

【0006】

【実施例】 次に本発明の実施例を詳述する。70℃に保持したルベアン酸(DTO-H)と陽記のエタノール溶液に、攪拌しながら硫酸銅水溶液を少量ずつ添加して行き、沈殿物を生成せしめた。完全に反応が終了するまで長時間放置した後、▲を通過して沈殿物を分取した。この沈殿物を、80℃で減圧乾燥を行った後、120℃で熱処理を行い、正極活物質aを得た。上記の硫酸銅水溶液の代りに、塩化ニッケル水溶液を使用し、上記と同様の方法で正極活物質bを得た。該正極活物質a及びbについて、示差熱分析及びXRD分析を行い、夫々の分析の結果、該正極活物質a、bは、下記化1に示す化学構造式を有する配位高分子錯体の一種であるルベアン酸錯体である(但、夫々の数値構造式中Mは、夫々Cu又はNi)ことを確認した。即ち、前者の正極活物質aは、DTO-Cu錯体、後者の正極活物質bはDTO-Ni錯体であることを確認した。

【0007】

【化1】



【0008】 実施例1

上記の正極活物質a 50重量部、導電剤としてアセチレンブラック20重量部をミルで混合し、この混合物を乳鉢上で、溶剤としてインプロピルアルコールを添加後十分に攪り、スラリ状になったところで、接着剤として60%ポリテトラフルオロエチレン水溶液30重量部を添加、攪拌して該混合剤をガム状としたものを小型圧延機によりシート状に成形し、これを金属集電体であるニッケルメッシュに圧着し、電極板とした。この電極板を正

(3)

特開平5-74458

極として用い、負極として金属リチウム、電解液として1モルの過塩素酸リチウムをプロピレンカーボネイトとジメトキシエタンの比率1:1の混合溶媒に溶かして成る非水電解液を用い、図1に示すセルを構成した。これをリチウム電池Aとした。

【0009】図1において、1はセル容器、2は正極板、3は負極板、4は非水電解液、5は正極端子、6は負極端子、7はリチウム電池の要部電極を示す。

【0010】実施例2

実施例1で使用した正極活物質aに代え、上記の正極活物質bを用いた以外は、実施例1と同様にして正極板を製造し、該正極板を用い図1に示すと同じ構造のセルを構成した。これをリチウム電池Bとした。

【0011】比較例

比較のため、正極活物質として従来の正極活物質である $MnO_2$ 、 $TiS_2$ 及びボリアニリンの3種を夫々使用し、実施例1と同様にして正極板を夫々製造し、その夫々を用い図1に示すと同じ構造のセルを構成した。これを夫々リチウム電池C、D、Eとした。

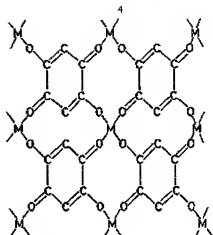
【0012】これらの電池A、B、C、D、Eについて放電試験（電流密度 $0.5\text{ mA/cm}^2$ ）を行った。その結果は、図2に示す通りであった。図面で、A、B、C、D、Eは、夫々電池A、B、C、D、Eの夫々の放電電圧特性曲線を示す。これから明らかなように、本発明の正極活物質a、bを用いた場合は、従来の上記正極活物質を用いた場合と異なり、その放電電圧は平坦性を保ち、安定な電圧の供給を可能とする効果をもたらす。

【0013】このように、本発明は、正極活物質として配位高分子錯体を使用することにより、安定した電圧の供給を受ける非水電解液電池を得ることが可能となつた。次に上記と實質的な差のない配位高分子錯体の実施例を詳述する。

【0014】70℃に保持した2，5-ジヒドロキシ-p-ベンゾキノン（ $DHQ-H_2$ と略記）のエタノール溶液に、攪拌しながら硫酸銅水溶液を少量ずつ添加して行き沈澱物を生成せしめた。完全に反応が終了するまで数時間放置した後、▲ろ過して沈澱物を分取した。この沈澱物を、80℃で減圧乾燥を行い正極活物質fを得た。上記の硫酸銅水溶液の代りに、塩化ニッケル水溶液を使用し、上記と同様の方法で正極活物質gを得た。該正極活物質f、gについて、示差熱分析及びXRD分析を行い、夫々の分析の結果、該正極活物質f、gは、下記化2に示す化学構造式を有する配位高分子錯体の一種であるルベンアミン錯体である（但、該構造式中Mは、該正極活物質fではCu、該正極活物質gではNi）ことを確認した。即ち、前者の正極活物質fは、 $DHQ-Cu$ 錯体、後者の正極活物質gは $DHQ-Ni$ 錯体であることを確認した。

【0015】

【化2】



【0016】実施例3

上記の正極活物質f 50重量部、溶媒剤としてアセチレンブラック20重量部をミルで混合し、この混合剤を乳鉢上で、溶媒剤としてイソプロピルアルコールを添加幾十分に練り、スラリー状になったところで、糊剤として60%ポリテトラフルオロエチレン水溶液30重量部を添加、攪拌して該混合剤をガム状としたものを水型圧延機によりシート状に成形し、これを金属集電体であるニッケルメッシュに圧着し、電極板とした。この電極板を正極として用い、負極として金属リチウム、電解液として1モルの過塩素酸リチウムをプロピレンカーボネイトとジメトキシエタンの比率1:1の混合溶媒に溶かして成る非水電解液を用い、図1に示すと同じ構造のセルを構成した。これをリチウム電池Fとした。

【0017】実施例4

実施例3で使用した正極活物質fに代え、上記の正極活物質gを用いた以外は、実施例3と同様にして正極板を製造し、これを用いて図1に示すと同じ構造のセルを構成した。これをリチウム電池Gとした。

【0018】これらの電池F、Gについて放電試験（電流密度 $0.5\text{ mA/cm}^2$ ）を行った。その結果は、図3に示す通りであった。図面で、F、Gは、夫々電池F、Gの夫々の放電電圧特性曲線を示す。比較のため、前記の従来の正極活物質を使用した電池C、D、Eの特性曲線C、D、Eを併記した。これから明らかなように、本発明の正極活物質f、gを用いた場合も、電池放電中、その放電電圧は平坦性に優れ、安定した電圧を供給し得ることが分る。

【0019】

【発明の効果】このように本発明によるときは、非水電解液電池の正極活物質として、分子内で非橋合化が可能で $DTO-Cu$ 錯体、 $DTO-Ni$ 錯体、 $DHQ-Cu$ 錯体、 $DHQ-Ni$ 錯体などの配位高分子錯体を使用するときは、安定した電圧の供給を可能とする効果をもたらす。

(4)

特開平5-74458

5

6

【図面の簡単な説明】

【図1】 本発明の実施の1例の非水電解液電池の断面図である。

【図2】 本発明の実施例の電池と従来電池との放電電圧特性の比較グラフである。

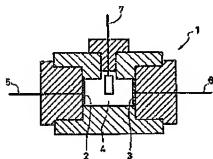
\* 【図3】 本発明の他の実施例の電池と従来電池との放電電圧特性の比較グラフである。

【符号の説明】

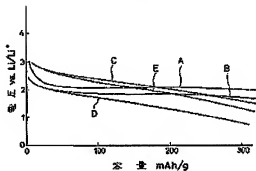
A、B、F、G 本発明電池の放電電圧特性曲線

本

【図1】



【図2】



【図3】

